PATENT ABSTRACTS OF JAPAN

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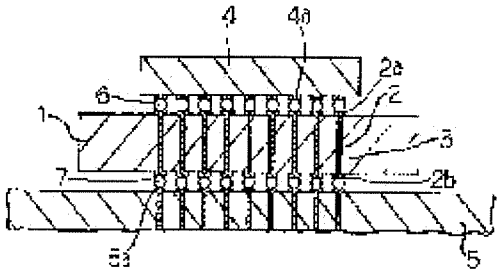
(54) WIRING BOARD

(57)Abstract:
PROBLEM TO BE SOLVED: To prevent a semiconductor device from malfunctioning by a noise which penetrates from an outer electric circuit board of the semiconductor element.
SOLUTION: The board comprises an insulation base 1 having through-holes 3 in the thickness direction and wiring layers 2 having first ends extending to the top face of the base 1, to form upper connection pads 2a connected to electrodes 4a of a semiconductor device 4 and second ends which extend to the bottom face of the base to form lower connection pads 2b connected to wiring conductors 5a of an outer electric circuit board 5. The base 1 is made of SiO2-Al2O3-MgO-MnO-B2O3 crystalline glass and contg. at least a magnetic material around the through-holes 3.



CLAIMS

[Claim(s)]

[Claim 1]A wiring board, wherein it is a wiring board characterized by comprising the following, and said insulating base comprises SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass and a magnetic material contains at least around a breakthrough.
An insulating base which has two or more breakthroughs in a thickness direction.
Two or more wiring layers which it fills up with in said breakthrough, form a top connection pad to which one end is drawn by the upper surface of an insulating base, and an electrode of a semiconductor device is connected, and form a lower connection pad to which the other end is drawn by the undersurface of an insulating base and a wiring conductor of an external electric circuit substrate is connected.

[Claim 2]The wiring board according to claim 1, wherein content of said magnetic material is 50 to 90 % of the weight.

[Claim 3]The wiring board according to claim 1 or 2 making said insulating base contain an inorganic substance filler of ten to 40 weight section by outside addition.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the wiring board by which loading connection of the semiconductor devices, such as LSI (large scale integration circuit element), is made.
[0002]
[Description of the Prior Art]Conventionally, the external electric circuit substrate by which loading connection of the semiconductor device is made comprises an insulating base which comprises electrical insulation materials, such as a nature sintered compact of an aluminum oxide, and two or more wiring conductors which are formed in the surface and the inside of this insulating base, and comprise metallic materials, such as tungsten, molybdenum, and manganese.
[0003]By generally adopting thick film formation art, such as the Mo-Mn method, this external electric circuit substrate is formed and specifically, To the metal powder which comprises refractory metals, such as tungsten, molybdenum, and manganese, an organic binder, Add a solvent etc. and print coating of paste state and the made metal paste is carried out to the prescribed pattern which serves as a wiring conductor with screen printing in the outside surface of raw or a sintered ceramic object, Next, this is calcinated in reducing atmosphere and it is formed by carrying out the sintering unification of a refractory metal and the ceramic body.
[0004]Corresponding to the miniaturization of electronic equipment, an external electric circuit substrate is also recently made small, And since it is required that a wiring conductor should be formed with high density and it corresponds to this, the external electric circuit substrate which changed the wiring conductor into forming with thick film formation art, and was formed by the thin film coating technology in which fine wiring is possible has also come to be used.
[0005]The external electric circuit substrate which formed this wiring conductor by thin film coating technology, The glue line which comprises tantalum nitride, a nickel chrome alloy, etc. on an insulating base, for example, The interlayer who comprises a nickel chrome alloy, a titanium tungsten alloy, nickel, palladium, etc., The initiative body whorl which comprises gold, copper, etc. is made to laminate one by one by adopting thin film coating technology, such as the ion plating method, sputtering process and vacuum deposition, and plating, next these each class is processed into a prescribed pattern with photolithography technology, and it is formed by considering it as a wiring conductor.
[0006]The semiconductor device to which this external electric circuit substrate has an electrode on the undersurface at the upper surface of an insulating base is laid, By joining the wiring conductor on the upper surface of an insulating base, and the electrode of the undersurface of a semiconductor device via Hitoshi Handa, loading connection of the semiconductor device will be made and a semiconductor device drives by taking a predetermined electrical signal in and out of a semiconductor device via a wiring conductor.
[0007]
[Problem(s) to be Solved by the Invention]However, the thing which an information processor is what highly efficient-ization progresses rapidly, and a high speed drive is performed in connection with this as for a semiconductor device, and is very easy to be influenced by a noise in recent years, Since the wiring conductor with which the conventional external electric

circuit substrate comprises tungsten, molybdenum, etc. made the noise of harmonics spread easily, when the noise of harmonics enters into the wiring conductor of a wiring board, This noise entered into the semiconductor device via the wiring conductor as it is, and had a fault of making a semiconductor device malfunction.

[0008]This invention was thought out in view of the above-mentioned fault, and the purpose, It is allotted between a semiconductor device and the conventional external electric circuit substrate, the noise which entered into the wiring conductor of an external electric circuit substrate is effectively prevented from entering into a semiconductor device as it is, and it is in providing the wiring board which can operate a semiconductor device normally over a long period of time.

[0009]

[Means for Solving the Problem]It fills up with this invention an insulating base which has two or more breakthroughs in a thickness direction, and in said breakthrough, A top connection pad to which an end is drawn by the upper surface of an insulating base and an electrode of a semiconductor device is connected is formed, It is a wiring board which comprises two or more wiring layers which form a lower connection pad to which the other end is drawn by the undersurface of an insulating base and a wiring conductor of an external electric circuit substrate is connected, Said insulating base comprises SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass, and a magnetic material contains it at least around the breakthrough.

[0010]This invention is characterized by content of said magnetic material being 50 to 90 % of the weight.

[0011]This invention made said insulating base contain an inorganic substance filler of ten to 40 weight section by outside addition.

[0012]According to the wiring board of this invention. When a noise spreads to a wiring layer provided in an insulating base since [to which a wiring layer is allotted while forming an insulating base with SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass] a magnetic material was made to contain at least around a breakthrough, With a magnetic material, the noise is changed into thermal energy, and is absorbed, as a result, a noise does not enter into a semiconductor device, and it becomes possible to always operate a semiconductor device normally.

[0013]According to the wiring board of this invention, calcination temperature of SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass which forms an insulating base is 800-1050 **, Since it is low, even if a magnetic material is made to contain and it calcinates it in this crystalline glass, a magnetic material does not lose magnetism, and it becomes possible to absorb a noise good.

[0014]The melting point of copper, silver, gold, etc. low [since calcination temperature of a glass ceramic sintered body is simultaneously low] **, When it becomes possible to form a wiring layer which comprises a low material of conduction resistance by simultaneous calcination and an electrical signal spreads a wiring layer, attenuation etc. can be effectively prevented from arising in an electrical signal, and a semiconductor device can also be operated correctly.

[0015]If an insulating base is made to contain an inorganic substance filler in the range of ten to 40 weight section by outside addition, a mechanical strength of an insulating base will

become strong, and breakage etc. can also be effectively prevented from inviting by external force impression.

[0016]

[Embodiment of the Invention]Next, this invention is explained in detail based on an accompanying drawing. Drawing 1 shows one example of the wiring board of this invention, 1 is an insulating base and 2 is a wiring layer.

[0017]Said insulating base 1 comprises SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass, Two or more breakthroughs 3 penetrated to the thickness direction are formed, and the wiring layer 2 which comprises the small metallic material of the conduction resistance which comprises copper, silver, gold, etc. is formed in this breakthrough 3.

[0018]The insulating base 1 which comprises said SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass, For example, SiO_2, aluminum$_2O_3$, MgO, ZnO, the suitable organic binder for the glass component powder which comprises B_2O_3, The green sheet (raw sheet) of two or more sheets is obtained by adopting a well-known doctor blade method, the calendering roll method, etc. conventionally, and fabricating this to a sheet shaped, while carrying out addition mixing of a solvent, the plasticizer, etc. and making with the shape of slurry, Next, while performing suitable punching processing for said green sheet, it laminates up and down in predetermined order, and while making with a generation form, it is manufactured by calcinating this generation form at the temperature of 800-1050 **.

[0019]The breakthrough 3 currently formed in said insulating base 1 is formed in 80 micrometers - 250 micrometers in diameter, for example by adopting the punching drilling processing method by a well-known metallic mold as the green sheet (raw sheet) which serves as the insulating base 1 by calcination conventionally.

[0020]The wiring layer 2 is formed in the breakthrough 3 formed in said insulating base 1, While this wiring layer 2 makes the operation which electrically connects the wiring conductor 5a of the external electric circuit substrate 5, and the electrode 4a of the semiconductor device 4, makes the upper surface of the insulating base 1 draw the end of the wiring layer 2 and forms the top connection pad 2a, The other end is drawn by the undersurface of the insulating base 1, and lower connection pad 2b is formed, The electrode 4a of the semiconductor device 4 is joined to the top connection pad 2a via the conductive jointing material 6 which comprises Hitoshi Handa, If lower connection pad 2b is made to join the wiring conductor 5a of the external electric circuit substrate 5 via the conductive jointing material 7 which comprises Hitoshi Handa, the electrode 4a of the semiconductor device 4 will be connected to the wiring conductor 5a of the external electric circuit substrate 5 via the wiring layer 2, By this, from an external electric circuit, an electrical signal can take in and out of the semiconductor device 4, and the semiconductor device 4 can be operated.

[0021]Said wiring layer 2 has the low melting point of copper, silver, gold, etc., and it is formed with the small metallic material of conduction resistance, Carry out addition mixing of an organic binder, a solvent, the plasticizer, etc. at metal powder, such as copper, silver, and gold, and metal paste is created, It is filled up with this metal paste by calcination in the breakthrough provided in the green sheet (raw sheet) used as the insulating base 1, and is formed by calcination of a green sheet and simultaneous calcination in the breakthrough 3 of the insulating base 1. In this case, since that calcination temperature of SiO_2-aluminum$_2O_3$-

$MgO-ZnO-B_2O_3$ system crystallinity glass is as low as 800-1050 **, The metal powder of metal paste does not exhale at the time of calcination of the insulating base 1, and it can form in the breakthrough 3 of the insulating base 1 by the insulating base 1 and simultaneous calcination.

[0022]Said wiring layer 2 can prevent attenuation etc. from arising in an electrical signal effectively, even if an electrical signal spreads the wiring layer 2, since conduction resistance, such as copper, silver, and gold, is formed with the low metallic material, and as a result, it can operate the semiconductor device 4 correctly.

[0023]The insulating base 1 which has the wiring layer 2 in said breakthrough 3, To the inside, $ZnFe_2O_4$, $MnFe_2O_4$, $FeFe_2O_4$, The magnetic material which comprises at least one sort of $CoFe_2O_4$, $NiFe_2O_4$, and $CuFe_2O_4$ contains, When the harmonic noise which entered into the wiring layer 2 from the external electric circuit spreads this magnetic material, the noise is changed into thermal energy, and is absorbed, the operation which prevents a noise from entering into a semiconductor device effectively is made, and it becomes possible by this to make it always operate normally of a semiconductor device.

[0024]Said magnetic material to the green sheet which serves as the insulating base 1 by calcination, for example. It contains in the insulating base 1 by carrying out addition content of the magnetic powder which comprises at least one sort of $ZnFe_2O_4$, $MnFe_2O_4$, $FeFe_2O_4$, $CoFe_2O_4$, $NiFe_2O_4$, and $CuFe_2O_4$.

[0025]The insulating base 1 containing said magnetic material, i.e., SiO_2-aluminum$_2O_3$-MgO-$ZnO-B_2O_3$ system crystallinity glass, The quantity of SiO_2-aluminum$_2O_3$-$MgO-ZnO-B_2O_3$ system crystallinity glass the insulating base 1 which comprises a magnetic material Less than 10 % of the weight, It becomes difficult to calcinate simultaneously with the wiring layer 2 to which the calcination temperature of SiO_2-aluminum$_2O_3$-$MgO-ZnO-B_2O_3$ system crystallinity glass will become high, and changes from metallic materials, such as copper, when it becomes that in which in other words the magnetic material exceeded 90 % of the weight, If the quantity of SiO_2-aluminum$_2O_3$-$MgO-ZnO-B_2O_3$ system crystallinity glass exceeds 50 % of the weight, and in other words a magnetic material will be less than 50 % of the weight, When a noise enters into the wiring layer 2 provided in the insulating base 1 from the wiring conductor 5a of the external electric circuit substrate 5, a noise will not be able to be absorbed good but the semiconductor device 4 will be made to cause malfunction. Therefore, the insulating base 1 which made said SiO_2-aluminum$_2O_3$-$MgO-ZnO-B_2O_3$ system crystallinity glass contain a magnetic material, It is preferred to make quantity of SiO_2-aluminum$_2O_3$-$MgO-ZnO-B_2O_3$ system crystallinity glass into 10 to 50% of the weight of the range, and to make quantity of a magnetic material into 50 to 90% of the weight of the range.

[0026]If said magnetic material is set [the particle diameter] to less than 0.5 micrometer again, when manufacturing the insulating base 1 by calcination, A reaction with SiO_2-aluminum$_2O_3$-$MgO-ZnO-B_2O_3$ system crystallinity glass advances, The survival rate of a magnetic material falls and it becomes impossible to absorb a noise effectively, If it exceeds 10 micrometers, it will become difficult to calcinate simultaneously with the wiring layer 2 to

which the calcination temperature of SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass will become high, and changes from metallic materials, such as copper. Therefore, as for said magnetic material, what the particle diameter is made into the range of 0.5 micrometer - 10 micrometers for is preferred.

[0027]It is important to form the insulating base 1 with SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass in the wiring board of this invention.

[0028]This SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass, For example, SiO_2:40-46 % of the weight, aluminum$_2O_3$:25-30 % of the weight, MgO:8-13 % of the weight, ZnO: It is formed at 6 to 9 % of the weight, and B_2O_3:8-11 % of the weight.

[0029]Said SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass, Although crystal phases, such as gahnite (ZnO-aluminum$_2O_3$), cordierite (2MgOand2aluminum$_2O_3$), and a spinel type crystal phase (MgO-aluminum$_2O_3$, ZnO-aluminum$_2O_3$), are generated at the time of calcination, It has the character in which the intensity of the insulating base 1 improves by generation of these crystal phases.

[0030]From 800-1050 ** and a low thing, the calcination temperature said SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass. When the melting point of copper, silver, gold, etc. is enabled to form the wiring layer 2 by the insulating base 1 and simultaneous calcination also as a low low material of ** and conduction resistance and an electrical signal spreads the wiring layer 2, attenuation etc. can be effectively prevented from arising in an electrical signal, and the semiconductor device 4 can be operated correctly.

[0031]Since the calcination temperature of said SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass is as low as 800-1050 **, even if it makes the magnetic material contain at the time of calcination, the magnetism of a magnetic material is not lost, It becomes possible to absorb the noise which entered into the wiring layer 2 by this good.

[0032]The specific inductive capacity low said SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass with about 5 (room temperature of 1 MHz) again **, Therefore, even if it makes the wiring layer 2 allotted in the breakthrough 3 of the insulating base 1 spread an electrical signal, a propagation delay is not invited, and it becomes possible to make the wiring layer 2 spread an electrical signal by this at high speed.

[0033]Said SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass, If the quantity of SiO_2 exceeds less than 40 % of the weight or 46 % of the weight, it will become difficult to calcinate simultaneously with the wiring layer 2 to which the calcination temperature of SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass will become high, and changes from metallic materials, such as copper. Therefore, as for the quantity of SiO_2, what is considered as 40 to 46% of the weight of the range is preferred.

[0034]If the quantity of aluminum$_2O_3$ exceeds less than 25 % of the weight or 30 % of the weight, it will become difficult to calcinate simultaneously with the wiring layer 2 to which the calcination temperature of SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass will

become high, and changes from metallic materials, such as copper. Therefore, as for the quantity of aluminum$_2$O$_3$, what is considered as 25 to 30% of the weight of the range is preferred.

[0035]When the insulating base 1 which comprises SiO$_2$-aluminum$_2$O$_3$-MgO-ZnO-B$_2$O$_3$ system crystallinity glass by calcination when the quantity of MgO will be less than 8 % of the weight is manufactured, Quantity of the cordierite (2MgOand2aluminum$_2$O$_3$) to generate can decrease, and intensity of the insulating base 1 cannot be raised greatly, If it exceeds 13 % of the weight, it will become difficult to calcinate simultaneously with the wiring layer 2 to which the calcination temperature of SiO$_2$-Al$_2$O$_3$-MgO-ZnO-B$_2$O$_3$ system crystallinity glass will become high, and changes from metallic materials, such as copper. Therefore, as for the quantity of MgO, what is considered as 8 to 13% of the weight of the range is preferred.

[0036]When the insulating base 1 which comprises SiO$_2$-aluminum$_2$O$_3$-MgO-ZnO-B$_2$O$_3$ system crystallinity glass by calcination when the quantity of ZnO will be less than 6 % of the weight is manufactured, Quantity of the gahnite (ZnO-aluminum$_2$O$_3$) to generate can decrease, and intensity of the insulating base 1 cannot be raised greatly, If it exceeds 9 % of the weight, it will become difficult to calcinate simultaneously with the wiring layer 2 to which the calcination temperature of SiO$_2$-aluminum$_2$O$_3$-MgO-ZnO-B$_2$O$_3$ system crystallinity glass will become high, and changes from metallic materials, such as copper. Therefore, as for the quantity of ZnO, what is considered as 6 to 9% of the weight of the range is preferred.

[0037]When the insulating base 1 which comprises SiO$_2$-aluminum$_2$O$_3$-MgO-ZnO-B$_2$O$_3$ system crystallinity glass by calcination when the quantity of B$_2$O$_3$ will be less than 8 % of the weight is manufactured, Gahnite (ZnO-aluminum$_2$O$_3$), cordierite (2MgOand2aluminum$_2$O$_3$), Crystal phases, such as a spinel type crystal phase (MgO-aluminum$_2$O$_3$, ZnO-aluminum$_2$O$_3$), are generated superfluously, If the insulating base 1 becomes a porous thing, and it becomes unsuitable as a wiring board and it exceeds 11 % of the weight, chemical resistance will deteriorate greatly and the reliability as a wiring board will fall greatly. Therefore, as for the quantity of B$_2$O$_3$, what is considered as 8 to 11% of the weight of the range is preferred.

[0038]On an inorganic substance filler and a concrete target, said SiO$_2$-aluminum$_2$O$_3$-MgO-ZnO-B$_2$O$_3$ system crystallinity glass at the inside Alumina, If 10-40 weight-section addition content of the powder, such as silica, silicon nitride, and alumimium nitride, is carried out by outside addition, it will be effectively prevented from a mechanical strength improving substantially and inviting breakage etc. by external force impression. Therefore, the mechanical strength of the insulating base 1 is raised, As for making it not invite breakage etc. by external force impression, it is preferred to make said SiO$_2$-aluminum$_2$O$_3$-MgO-ZnO-B$_2$O$_3$ system crystallinity glass carry out 10-40 weight-section addition content of the inorganic substance filler by outside addition, and to form the insulating base 1 in it.

[0039]If the particle diameter is further made into the range of 0.5-5 micrometers, said inorganic substance filler can carry out distributed content uniformly into a glass ceramic sintered body, and can raise the mechanical strength of the insulating base 1 uniformly. Therefore, as for said inorganic substance filler, what the particle diameter is made into the

range of 0.5-5 micrometers for is preferred.
[0040]This invention is not limited to an above-mentioned example, when it was a range which does not deviate from the gist of this invention, it made the whole insulating base 1 various change contain a magnetic material in an above-mentioned example possible, but it may make a magnetic material contain only on the outskirts of breakthrough 3 of the insulating base 1. In this case, what is necessary is to make into the range of 10-50 quantity of the SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass of the field which a magnetic material contains, and just to let quantity of the magnetic material be 50 to 90% of the weight of a range.
[0041]Although the Plastic solid which laminated two or more green sheets was calcinated and the insulating base 1 was created in the above-mentioned example, one Plastic solid which fabricated this by press forming etc. may be calcinated and created. The thing which made SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass contain a magnetic material when calcinating the Plastic solid which laminated two or more green sheets simultaneously and creating the insulating base 1, The thing which made SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass contain an inorganic substance filler may be allotted to a multilayer, and may be created.
[0042]
[Effect of the Invention]According to the wiring board of this invention. When a noise spreads to the wiring layer provided in the insulating base since [to which a wiring layer is allotted while forming an insulating base with SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass] the magnetic material was made to contain at least around a breakthrough, With a magnetic material, the noise is changed into thermal energy, and is absorbed, as a result, a noise does not enter into a semiconductor device, and it becomes possible to always operate a semiconductor device normally.
[0043]According to the wiring board of this invention, the calcination temperature of the SiO_2-aluminum$_2O_3$-MgO-ZnO-B_2O_3 system crystallinity glass which forms an insulating base is 800-1050 **, Since it is low, even if a magnetic material is made to contain and it calcinates it in this crystalline glass, a magnetic material does not lose magnetism, and it becomes possible to absorb a noise good.
[0044]The melting point of copper, silver, gold, etc. low [since the calcination temperature of a glass ceramic sintered body is simultaneously low] **, When it becomes possible to form the wiring layer which comprises a low material of conduction resistance by simultaneous calcination and an electrical signal spreads a wiring layer, attenuation etc. can be effectively prevented from arising in an electrical signal, and a semiconductor device can also be operated correctly.
[0045]If an insulating base is made to contain an inorganic substance filler in the range of ten to 40 weight section by outside addition, the mechanical strength of an insulating base will become strong, and breakage etc. can also be effectively prevented from inviting by external force impression.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a sectional view showing one example of the wiring board of this invention.
[Description of Notations]
1 ... Insulating base
2 ... Wiring layer
2a .. Top connection pad
2b .. Lower connection pad
3 ... Breakthrough
4 ... Semiconductor device
4a .. Electrode of a semiconductor device
5 ... External electric circuit substrate
5a .. Wiring conductor of an external electric circuit substrate

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[Translation done.]

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審査請求　未請求　請求項の数３　ＯＬ　（全　５　頁）

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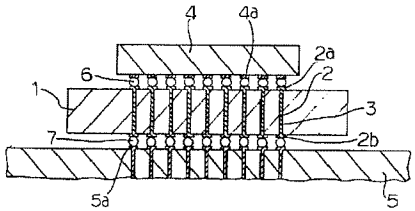
(54)【発明の名称】　配線基板

(57)【要約】
【課題】半導体素子の外部電気回路基板よりノイズが入り込み、半導体素子が誤動作する。
【解決手段】厚み方向に複数個の貫通孔３を有する絶縁基体１と、前記貫通孔３内に充填され、一端が絶縁基体１の上面に導出されて半導体素子４の電極４ａが接続される上部接続パッド２ａを形成し、他端が絶縁基体１の下面に導出されて外部電気回路基板５の配線導体５ａが接続される下部接続パッド２ｂを形成する複数個の配線層２とから成る配線基板であって、前記絶縁基体１はＳｉＯ２－Ａｌ２Ｏ３－ＭｇＯ－ＺｎＯ－Ｂ２Ｏ３系結晶性ガラスから成り、かつ少なくとも貫通孔３周辺に磁性材料が含有させた。



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【特許請求の範囲】
【請求項１】厚み方向に複数個の貫通孔を有する絶縁基体と、前記貫通孔内に充填され、一端が絶縁基体の上面に導出されて半導体素子の電極が接続される上部接続パッドを形成し、他端が絶縁基体の下面に導出されて外部電気回路基板の配線導体が接続される下部接続パッドを形成する複数個の配線層とから成る配線基板であって、前記絶縁基体はＳｉＯ２－Ａｌ２Ｏ３－ＭｇＯ－ＺｎＯ－Ｂ２Ｏ３系結晶性ガラスから成り、かつ少なくとも貫通孔周辺に磁性材料が含有されていることを特徴とする配線基板。
【請求項２】前記磁性材料の含有量が５０～９０重量％であることを特徴とする請求項１に記載の配線基板。
【請求項３】前記絶縁基体に、外添加で１０～４０重量部の無機物フィラーを含有させたことを特徴とする請求項１又は２に記載の配線基板。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、ＬＳＩ（大規模集積回路素子）等の半導体素子が搭載接続される配線基板に関するものである。
【０００２】
【従来の技術】従来、半導体素子が搭載接続される外部電気回路基板は酸化アルミニウム質焼結体等の電気絶縁材料から成る絶縁基体と、該絶縁基体の表面及び内部に形成され、タングステン、モリブデン、マンガン等の金属材料から成る複数個の配線導体とで構成されている。
【０００３】かかる外部電気回路基板は一般にＭｏ－Ｍｎ法等の厚膜形成技術を採用することによって形成され、具体的には、タングステン、モリブデン、マンガン等の高融点金属から成る金属粉末に有機バインダー、溶剤等を添加し、ペースト状となした金属ペーストを生もしくは焼結セラミック体の外表面にスクリーン印刷法により配線導体となる所定パターンに印刷塗布し、次にこれを還元雰囲気中で焼成し、高融点金属とセラミック体とを焼結一体化させることによって形成されている。
【０００４】また近時、電子機器の小型化に対応して外部電気回路基板も小型にして、かつ配線導体を高密度に形成することが要求されるようになってきており、これに対応するために配線導体を厚膜形成技術で形成するのに変えて微細配線が可能な薄膜形成技術で形成した外部電気回路基板も使用されるようになってきた。
【０００５】この配線導体を薄膜形成技術で形成した外部電気回路基板は、絶縁基体上に、例えば、窒化タンタルやニッケル・クロム合金等から成る接着層と、ニッケル・クロム合金やチタン・タングステン合金、ニッケル、パラジウム等から成る中間層と、金や銅等から成る主導体層をイオンプレーティング法やスパッタリング法、蒸着法、メッキ法等の薄膜形成技術を採用することによって順次被着させ、次に、これらの各層をフォトリソグラフィー技術で所定パターンに加工し、配線導体とすることによって形成されている。
【０００６】かかる外部電気回路基板は、絶縁基体の上面に、下面に電極を有する半導体素子が載置され、絶縁基体上面の配線導体と半導体素子の下面の電極とを半田等を介し接合させることによって半導体素子が搭載接続されることとなり、配線導体を介して半導体素子に所定の電気信号を出し入れすることによって半導体素子が駆動する。
【０００７】
【発明が解決しようとする課題】しかしながら、近年、情報処理装置は高性能化が急激に進展し、これに伴って半導体素子も高速駆動が行われ、ノイズの影響を極めて受け易いものになってきたこと、従来の外部電気回路基板はタングステン、モリブデン等から成る配線導体が高調波のノイズを伝搬させ易いこと等から配線基板の配線導体に高調波のノイズが入り込んだ場合、このノイズがそのまま配線導体を介して半導体素子に入り込み、半導体素子を誤動作させるという欠点を有していた。
【０００８】本発明は、上記欠点に鑑み案出されたもので、その目的は、半導体素子と従来の外部電気回路基板との間に配され、外部電気回路基板の配線導体に入り込んだノイズがそのまま半導体素子に入り込むのを有効に防止し、半導体素子を長期間にわたり正常に作動させることができる配線基板を提供することにある。
【０００９】
【課題を解決するための手段】本発明は、厚み方向に複数個の貫通孔を有する絶縁基体と、前記貫通孔内に充填され、一端が絶縁基体の上面に導出されて半導体素子の電極が接続される上部接続パッドを形成し、他端が絶縁基体の下面に導出されて外部電気回路基板の配線導体が接続される下部接続パッドを形成する複数個の配線層とから成る配線基板であって、前記絶縁基体はＳｉＯ２－Ａｌ２Ｏ３－ＭｇＯ－ＺｎＯ－Ｂ２Ｏ３系結晶性ガラスから成り、かつ少なくとも貫通孔周辺に磁性材料が含有されていることを特徴とするものである。
【００１０】また本発明は前記磁性材料の含有量が５０～９０重量％であることを特徴とするものである。
【００１１】更に本発明は、前記絶縁基体に、外添加で１０～４０重量部の無機物フィラーを含有させたことを特徴とするものである。
【００１２】本発明の配線基板によれば、絶縁基体をＳｉＯ２－Ａｌ２Ｏ３－ＭｇＯ－ＺｎＯ－Ｂ２Ｏ３系結晶性ガラスで形成するとともに配線層が配される少なくとも貫通孔周辺に磁性材料を含有させたことから絶縁基体に設けた配線層にノイズが伝搬した場合、そのノイズは磁性材料で熱エネルギーに変換されて吸収され、その結果、ノイズが半導体素子に入り込むことはなく、半導体素子を常に正常に作動させることが可能となる。
【００１３】また本発明の配線基板によれば、絶縁基体

を形成するSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスの焼成温度が800～1050℃であり、低いことからこの結晶性ガラス中に磁性材料を含有させて焼成しても磁性材料は磁性を失うことはなく、ノイズを良好に吸収することが可能となる。

【0014】同時にガラスセラミック焼結体の焼成温度が低いことから銅、銀、金等の融点が低くく、導通抵抗の低い材料から成る配線層を同時焼成によって形成することが可能となり、配線層を電気信号が伝搬した際、電気信号に減衰等が生じるのを有効に防止して半導体素子を正確に作動させることもできる。

【0015】更に絶縁基体に無機物フィラーを外添加で10～40重量部の範囲で含有させると絶縁基体の機械的強度が強くなり、外力印加によって破損等が招来するのを有効に防止することもできる。

【0016】

【発明の実施の形態】次に本発明を添付図面に基づき詳細に説明する。図1は本発明の配線基板の一実施例を示し、1は絶縁基体、2は配線層である。

【0017】前記絶縁基体1はSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスから成り、その厚み方向に貫通する複数個の貫通孔3が形成されており、該貫通孔3内には銅、銀、金等から成る導通抵抗の小さい金属材料から成る配線層2が形成されている。

【0018】前記SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスから成る絶縁基体1は、例えば、SiO_2、Al_2O_3、MgO、ZnO、B_2O_3から成るガラス成分粉末に適当な有機バインダー、溶剤、可塑剤等を添加混合して泥漿状となすとともにこれを従来周知のドクターブレード法やカレンダーロール法等を採用しシート状に成形することによって複数枚のグリーンシート（生シート）を得、次に、前記グリーンシートに適当な打ち抜き加工を施すとともに所定の順に上下に積層して生成形体となすとともに該生成形体を800～1050℃の温度で焼成することによって製作される。

【0019】また前記絶縁基体1に形成されている貫通孔3は、焼成によって絶縁基体1となるグリーンシート（生シート）に従来周知の金型によるパンチング孔開け加工法を採用することによって、例えば、直径80μm～250μmに形成される。

【0020】前記絶縁基体1に形成した貫通孔3内には配線層2が形成されており、該配線層2は外部電気回路基板5の配線導体5aと半導体素子4の電極4aとを電気的に接続する作用をなし、配線層2の一端を絶縁基体1の上面に導出させて上部接続パッド2aを形成するとともに、他端を絶縁基体1の下面に導出されて下部接続パッド2bを形成し、上部接続パッド2aに半導体素子4の電極4aを半田等から成る導電性接合材6を介して接合させ、下部接続パッド2bに外部電気回路基板5の配線導体5aを半田等から成る導電性接合材7を介して接合させれば半導体素子4の電極4aは配線層2を介して外部電気回路基板5の配線導体5aに接続されることとなり、これによって外部電気回路より半導体素子4に電気信号が出し入れし、半導体素子4を作動させることができる。

【0021】前記配線層2は銅、銀、金等の融点が低く、導通抵抗の小さい金属材料によって形成されており、銅、銀、金等の金属粉末に有機バインダー、溶剤、可塑材等を添加混合して金属ペーストを作成し、この金属ペーストを焼成によって絶縁基体1となるグリーンシート（生シート）に設けた貫通孔内に充填しておき、グリーンシートの焼成と同時焼成によって絶縁基体1の貫通孔3内に形成される。この場合、SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスはその焼成温度が800～1050℃と低いため、絶縁基体1の焼成時に金属ペーストの金属粉末が気散してしまうことはなく、絶縁基体1と同時焼成によって絶縁基体1の貫通孔3内に形成することができる。

【0022】なお、前記配線層2は銅、銀、金等の導通抵抗が低い金属材料で形成されていることから配線層2を電気信号が伝搬しても電気信号に減衰等が生じるのを有効に防止することができ、その結果、半導体素子4を正確に作動させることができる。

【0023】また前記貫通孔3内に配線層2を有する絶縁基体1は、その内部に$ZnFe_2O_4$、$MnFe_2O_4$、$FeFe_2O_4$、$CoFe_2O_4$、$NiFe_2O_4$、$CuFe_2O_4$の少なくとも1種から成る磁性材料が含有されており、該磁性材料は配線層2に外部電気回路から入り込んだ高調波ノイズが伝搬した場合、そのノイズを熱エネルギーに変換して吸収し、ノイズが半導体素子に入り込むのを有効に防止する作用をなし、これによって半導体素子は常に正常に作動させることが可能となる。

【0024】前記磁性材料は、例えば、焼成によって絶縁基体1となるグリーンシートに、$ZnFe_2O_4$、$MnFe_2O_4$、$FeFe_2O_4$、$CoFe_2O_4$、$NiFe_2O_4$、$CuFe_2O_4$の少なくとも1種から成る磁性粉末を添加含有させておくことによって絶縁基体1内に含有される。

【0025】前記磁性材料を含有する絶縁基体1、即ち、SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスと、磁性材料とより成る絶縁基体1はSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスの量が10～50重量%の範囲に、磁性材料の量を50～90重量%の範囲にしておくことが好ましい。

が50重量%を超え、言い換えると磁性材料が50重量%未満となると、絶縁基体1に設けた配線層2に外部電気回路基板5の配線導体5aよりノイズが入り込んだ場合、ノイズを良好に吸収することができず、半導体素子4に誤動作を起こさせてしまう。従って、前記SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスに磁性材料を含有させた絶縁基体1は、SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスの量を10～50重量%の範囲に、磁性材料の量を50～90重量%の範囲にしておくことが好ましい。

【0026】前記磁性材料はまたその粒径が0．5μm未満となると、焼成によって絶縁基体1を製作する際、SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスとの反応が進行し、磁性材料の残存率が低下してノイズを効果的に吸収することができなくなり、また10μmを超えるとSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスの焼成温度が高いものとなって銅等の金属材料から成る配線層2と同時に焼成するのが困難となる。従って、前記磁性材料はその粒径を0．5μm～10μmの範囲としておくことが好ましい。

【0027】本発明の配線基板においては絶縁基体1をSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスで形成することが重要である。

【0028】このSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスは、例えば、SiO_2：40～46重量%、Al_2O_3：25～30重量%、MgO：8～13重量%、ZnO：6～9重量%、B_2O_3：8～11重量%で形成されている。

【0029】前記SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスは、焼成時にガーナイト（$ZnO \cdot Al_2O_3$）、コージェライト（$2MgO \cdot 2Al_2O_3$）、スピネル型結晶相（$MgO \cdot Al_2O_3$、$ZnO \cdot Al_2O_3$）等の結晶相を生成するが、これらの結晶相の生成により絶縁基体1の強度が向上するという性質を持っている。

【0030】また前記SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスはその焼成温度が800～1050℃と低いことから、配線層2を銅、銀、金等の融点が低くく、導通抵抗の低い材料としても絶縁基体1と同時焼成によって形成することが可能となり、配線層2を電気信号が伝搬した際、電気信号に減衰等が生じるのを有効に防止して半導体素子4を正確に作動させることができる。

【0031】更に前記SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスの焼成温度が800～1050℃と低いことから焼成時に磁性材料を含有させておいても磁性材料の磁性が失われることはなく、これによって配線層2に入り込んだノイズを良好に吸収することが可能となる。

【0032】前記SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスはまたその比誘電率が約5（室温1MHz）と低くく、そのため絶縁基体1の貫通孔3内に配されている配線層2に電気信号を伝搬させても伝搬遅延を招来することはなく、これによって配線層2に高速で電気信号を伝搬させることが可能となる。

【0033】なお、前記SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスは、SiO_2の量が40重量%未満、或いは46重量%を超えるとSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスの焼成温度が高いものとなって銅等の金属材料から成る配線層2と同時に焼成するのが困難となる。従って、SiO_2の量は40～46重量%の範囲としておくことが好ましい。

【0034】またAl_2O_3の量が25重量%未満、或いは30重量%を超えるとSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスの焼成温度が高いものとなって銅等の金属材料から成る配線層2と同時に焼成するのが困難となる。従って、Al_2O_3の量は25～30重量%の範囲としておくことが好ましい。

【0035】またMgOの量が8重量%未満となると焼成によってSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスから成る絶縁基体1を製作する際、生成するコージェライト（$2MgO \cdot 2Al_2O_3$）の量が少なくなって絶縁基体1の強度を大きく向上させることができず、また13重量%を超えるとSiO_2-Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスの焼成温度が高いものとなって銅等の金属材料から成る配線層2と同時に焼成するのが困難となる。従って、MgOの量は8～13重量%の範囲としておくことが好ましい。

【0036】またZnOの量が6重量%未満となると焼成によってSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスから成る絶縁基体1を製作する際、生成するガーナイト（$ZnO \cdot Al_2O_3$）の量が少なくなって絶縁基体1の強度を大きく向上させることができず、また9重量%を超えるとSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスの焼成温度が高いものとなって銅等の金属材料から成る配線層2と同時に焼成するのが困難となる。従って、ZnOの量は6～9重量%の範囲としておくことが好ましい。

【0037】またB_2O_3の量が8重量%未満となると焼成によってSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスから成る絶縁基体1を製作する際、ガーナイト（$ZnO \cdot Al_2O_3$）、コージェライト（$2MgO \cdot 2Al_2O_3$）、スピネル型結晶相（$MgO \cdot Al_2O_3$、$ZnO \cdot Al_2O_3$）等の結晶相が過剰に生成され、絶縁基体1が多孔質のものとなって配線基板として不向きとなり、また11重量%を超えると耐薬品性が大きく劣化して配線基板としての信頼性が大

きく低下してしまう。従って、B_2O_3の量は８～１１重量％の範囲としておくことが好ましい。

【００３８】更に前記SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスはその内部に無機物フィラー、具体的にはアルミナ、シリカ、窒化珪素、窒化アルミニウム等の粉末を外添加で１０～４０重量部添加含有させておくと機械的強度が大幅に向上し、外力印加によって破損等を招来するのが有効に防止される。従って、絶縁基体１の機械的強度を向上させ、外力印加によって破損等を招来しないようにするのは前記SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスに無機物フィラーを外添加で１０～４０重量部添加含有させて絶縁基体１を形成することが好ましい。

【００３９】前記無機物フィラーは更にその粒径を０．５～５μmの範囲としておくとガラスセラミック焼結体中に均一に分散含有させて絶縁基体１の機械的強度を均一に向上させることができる。従って、前記無機物フィラーはその粒径を０．５～５μmの範囲としておくことが好ましい。

【００４０】なお、本発明は上述の実施例に限定されるものではなく、本発明の要旨を逸脱しない範囲であれば種々の変更は可能であり、例えば、上述の実施例においては絶縁基体１の全体に磁性材料を含有させたが、磁性材料を絶縁基体１の貫通孔３周辺のみに含有させてもよい。この場合、磁性材料が含有される領域のSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスの量を１０～５０の範囲とし、磁性材料の量を５０～９０重量％の範囲としておけばよい。

【００４１】また上述の実施例では複数のグリーンシートを積層した成形体を焼成して絶縁基体１を作成したが、これをプレス成形等によって成形した１つの成形体を焼成して作成してもよい。また同時に複数のグリーンシートを積層した成形体を焼成して絶縁基体１を作成する際、SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスに磁性材料を含有させたものと、SiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスに無機物フィラーを含有させたものとを多層に配して作成してもよい。

【００４２】

【発明の効果】本発明の配線基板によれば、絶縁基体をSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスで形成するとともに配線層が配される少なくとも貫通孔周辺に磁性材料を含有させたことから絶縁基体に設けた配線層にノイズが伝搬した場合、そのノイズは磁性材料で熱エネルギーに変換されて吸収され、その結果、ノイズが半導体素子に入り込むことはなく、半導体素子を常に正常に作動させることが可能となる。

【００４３】また本発明の配線基板によれば、絶縁基体を形成するSiO_2－Al_2O_3－MgO－ZnO－B_2O_3系結晶性ガラスの焼成温度が８００～１０５０℃であり、低いことからこの結晶性ガラス中に磁性材料を含有させて焼成しても磁性材料は磁性を失うことはなく、ノイズを良好に吸収することが可能となる。

【００４４】同時にガラスセラミック焼結体の焼成温度が低いことから銅、銀、金等の融点が低く、導通抵抗の低い材料から成る配線層を同時焼成によって形成することが可能となり、配線層を電気信号が伝搬した際、電気信号に減衰等が生じるのを有効に防止して半導体素子を正確に作動させることもできる。

【００４５】更に絶縁基体に無機物フィラーを外添加で１０～４０重量部の範囲で含有させると絶縁基体の機械的強度が強くなり、外力印加によって破損等が招来するのを有効に防止することもできる。

【図面の簡単な説明】

【図１】本発明の配線基板の一実施例を示す断面図である。

【符号の説明】

１・・・絶縁基体
２・・・配線層
２ａ・・上部接続パッド
２ｂ・・下部接続パッド
３・・・貫通孔
４・・・半導体素子
４ａ・・半導体素子の電極
５・・・外部電気回路基板
５ａ・・外部電気回路基板の配線導体

【図１】